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What Are We Thinking About When We Are Thinking About Computers?

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Computers offer themselves as models of mind and as “objects to think with.” They do this in several ways. There is, first of all, the world of computational theories. Some artificial intelligence researchers explicitly endeavor to build machines that model the human mind. Proponents of artificial life use computational processes capable of replication and evolution to redraw the boundaries of what counts as “alive.” And second, there is the world of computational objects themselves: everything from toys and games to simulation software and Internet connections. Such mundane objects of the computer culture influence thinking about self, life, and mind no less than the models of the computational philosophers. Computers in everyday life make possible a theoretical tinkering similar to what Claude Lévi-Strauss (1968) described as *bricolage*—the process by which individuals and cultures use the objects around them to reconfigure the boundaries of their cognitive categories.

Here I present examples of how engaging with a variety of computational objects (interfaces, virtual communities, and simulation games) provides material for reshaping categories of knowing, of identity, and of what is alive.

I. THINKING ABOUT KNOWING THROUGH THE PRACTICE OF INTERFACES

In the 1980s most computer users who spoke of transparency were referring to a transparency analogous to that of traditional machines, an ability to “open the hood” and poke around. But when, in the mid-1980s, Macintosh computer users began to talk about transparency, they were talking about seeing their documents and programs represented by attractive and easy-to-interpret icons. They were referring to an ability to make things work without needing to go below the screen surface. This was, somewhat paradoxically, a kind of transparency enabled by complexity and opacity. As one user said, “The Mac looked perfect, finished. To install a program on my

DOS machine, I had to fiddle with things. It clearly wasn't perfect. With the Mac, the system told me to stay on the surface." This is the kind of computer interface that has come to dominate the field; no longer associated only with the Macintosh, it is nearly universal in personal computing.

Today, the word "transparency" has taken on its Macintosh meaning in both computer talk and colloquial language. In our culture of simulation, when people say that something is transparent, they mean that they can easily see how to make it work. They don't mean that they know why it is working by reference to an underlying process.

"Your orgot is being eaten up," flashes the message on the screen. It is a rainy Sunday afternoon and I am with Tim, thirteen. We are playing SimLife, Tim's favorite computer game, which sets its users to the task of creating a functioning ecosystem. "What's an orgot?" I ask Tim. He doesn't know. "I just ignore that," he says confidently. "You don't need to know that kind of stuff to play." I suppose I look unhappy, haunted by a lifetime habit of not proceeding to step two before I understand step one, because Tim tries to appease me by coming up with a working definition of orgot. "I think it is sort of like an organism. I never read that, but just from playing, I would say that's what it is."

The orgot issue will not die. A few minutes later the game informs us: "Your fig orgot moved to another species." I say nothing, but Tim reads my mind and shows compassion: "Don't let it bother you if you don't understand. I just say to myself that I probably won't be able to understand the whole game anytime soon. So I just play." I begin to look through dictionaries in which orgot is not listed and finally find a reference to it embedded in the game itself, in a file called READ ME. The text apologizes for the fact that orgot has been given several and in some ways contradictory meanings in this version of SimLife, but one of them is close to organism. Tim was right—enough.

Tim's approach to SimLife is highly functional. He says he learned his style of play from video games: "Even though SimLife's not a video game, you can play it like one." By this he means that in SimLife, as in video games, one learns from the process of play. You do not first read a rulebook or get your terms straight. At one point in the game he says, "My trilobytes went extinct. They must have run out of algae. I didn't give them algae. I forgot. I think I'll do that now." Tim can keep playing, acting on an intuitive sense of what will work even when he has no very clear idea what is driving events. When his sea urchins become extinct, I ask him why.

Tim: I don't know, it's just something that happens.

ST: Do you know how to find out why it happened?

Tim: No.

ST: Do you mind that you can't tell why?

Tim: No. I don't let things like that bother me. It's not what's important.

People use contact with technology to keep in touch with their times, to discover "what's important." The transparent early IBM PC modeled a modernist technological aesthetic, the Macintosh-style interface was consistent with a postmodern one whose theorists suggest that the search for depth and mechanism is futile, and that it is more realistic to explore the world of shifting surfaces than to embark on a search for origins and structure. From this point of view, the kind of simulation Tim is using helps people think through current challenges to traditional epistemologies where the manifest refers back to the latent, the signifier to the signified. Tim's simulation is dynamic, seductive, and elusive, a world without depth, a world of surface.

Culturally, such simulations serve as emissaries for particular meanings of what it means to "know." We are increasingly accustomed to navigating screen simulations and have grown less

likely to ask of them, "What makes you work?" We learn to stay at the surface, taking things at (inter)face value.

2. THINKING ABOUT IDENTITY THROUGH THE CREATION OF VIRTUAL PERSONAE

In the late 1960s and early 1970s, I was first exposed to notions that linked identity and multiplicity. My introduction to these ideas, most notably that there is no such thing as "the ego"—that each of us is a multiplicity of parts, fragments, and desiring connections—took place in the intellectual hothouse of Paris; they presented the world according to such authors as Jacques Lacan, Gilles Deleuze, and Félix Guattari. But despite such ideal conditions for absorbing theory, for me, the "French lessons" remained merely abstract exercises. These theorists of post-structuralism, and what would come to be called postmodernism, spoke words that addressed the relationship between mind and body but from my point of view had little to do with my own.

In my lack of personal connection with these ideas, I was not alone. To take one example, for many people it is hard to accept any challenge to the idea of an autonomous ego. While in recent years, psychologists, social theorists, psychoanalysts, and philosophers have argued that the self should be thought of as essentially decentered, the normal requirements of everyday life exert strong pressure on people to take responsibility for their actions and to see themselves as unitary actors. This disjuncture between theory (the unitary self is an illusion) and lived experience (the unitary self is the most basic reality) is one of the main reasons why multiple and decentered theories have been slow to catch on—or when they do, why we tend to settle back quickly into older, centralized ways of looking at things.

When twenty years later, I used my personal computer and modem to join on-line communities, I experienced my French lessons in action, their theories brought almost shockingly down to earth. In virtual communities I used language to create several characters (some of my biological gender, others not of my biological gender). My textual actions were my actions—my words made things happen. In different communities I had different routines, different friends, different names. And different on-line personae were expressing different aspects of my self. In this context, the notion of a decentered identity were concretized by experiences on a computer screen. In this environment, people think not so much about identity as about identity crises.

Through networked software known as MUDs (short for MULTI-USER DUNGEONS or MULTI-USER DOMAINS), people from all over the world log in, each at his or her individual machine, and join on-line virtual communities that exist only through and in the computer. MUDs are social virtual realities in which hundreds of thousands of people participate. The key element of "MUDding," the creation and projection of a "personae" into a virtual space, also characterizes the far more "banal" on-line communities such as those of bulletin boards, newsgroups, and "chat" rooms on commercial services.

When you join a MUD, you create a character or several characters, you specify each one's gender and other physical and psychological attributes. Other players in the MUD can see its description. It becomes your character's self-presentation. The created characters need not be human and there may be more than two genders. Players create characters who have casual and

romantic sex, hold jobs, attend rituals and celebrations, fall in love, and get married. To say the least, such goings-on are gripping: "This is more real than my real life," says a character who turns out to be a man playing a woman who is pretending to be a man. As players participate in MUDs, they become authors not only of text, but of themselves, constructing selves through social interaction.

In traditional role-playing games in which one's physical body is present, one steps in and out of a character; MUDs, in contrast, offer a parallel life. The boundaries of the game are fuzzy; the routine of playing them becomes part of their players' everyday lives. MUDs blur the boundaries between self and game, self and role, self and simulation. One player says, "You are what you pretend to be . . . you are what you play." Players sometimes talk about their real selves as a composite of their characters and sometimes talk about their MUD characters as means for working on their "real" lives. An avid participant in the on-line "talk channels" known as Internet Relay Chat describes a similar feeling: "I go from channel to channel depending on my mood. . . . I actually feel a part of several of the channels, several conversations. . . . I'm different in the different chats. They bring out different things in me."

Often, players on MUDs and the most avid participants in on-line life are people who work with computers all day at their "regular" jobs. As they play on MUDs it is common practice for them periodically to put their virtual personae to "sleep," remaining logged on to the game, but pursuing other activities. From time to time, they return to the game space. In this way, they break up their work days and experience their lives as a "cycling through" between the real world and a series of simulated ones. This same sort of "cycling through" characterizes how people play with newsgroups, Internet Relay Chat, bulletin boards, and chat rooms.

This kind of interaction with MUDs and other virtual environments is made possible by the existence of what have come to be called "windows" in modern computing environments. Windows are a way of working with a computer that makes it possible for the machine to place you in several contexts at the same time. As a user, you are attentive to only one of the windows on your screen at any given moment, but in a certain sense, you are a presence in all of them at all times. You might be writing a paper in bacteriology and using your computer in several ways to help you: you are "present" to a word-processing program in which you are taking notes and collecting thoughts; you are "present" to communication software though you are in touch with a distant computer in order to collect reference materials; and you are "present" to a simulation program which is charting the growth of bacterial colonies when a new organism enters their ecology. Each of these activities takes place in a "window," and your identity on the computer is the sum of your distributed presence.

This certainly is the case for Doug, a Dartmouth College junior who plays four characters distributed across three different MUDs. One is a seductive woman. One is a macho, cowboy type whose self-description stresses that he is a "Marlboros rolled in the tee shirt sleeve kind of guy." Then there is "Carrot," a rabbit of unspecified gender who wanders through its MUD introducing people to each other. Doug says, "Carrot is so low-key that people let it be around while they are having private conversations. So I think of Carrot as my passive, voyeuristic character." Doug's fourth character is one that he plays on a FurryMUD (MUDs on which all the characters are furry animals). "I'd rather not even talk about that character because its anonymity there is very important to me," Doug says. "Let's just say that on FurryMUDs I feel like a sexual tourist." Doug talks about playing his characters in windows that have enhanced his ability to "turn pieces of my mind on and off."

I split my mind. I'm getting better at it. I can see myself as being two or three or more. And I just turn on one part of my mind and then another when I go from window to window. I'm in some kind of argument in one window and trying to come on to a girl in a MUD in another, and another window might be running a spreadsheet program or some other technical thing for school. . . . And then I'll get a real-time message [that flashes on the screen as soon as it is sent from another system user], and I guess that's RL. It's just one more window.

The development of the windows metaphor for computer interfaces was a technical innovation motivated by the desire to get people working more efficiently by cycling through different applications, much as time-sharing computers cycled through the computing needs of different people. But in practice, windows have become a potent metaphor for thinking about the self as a multiple and distributed system. The self is no longer simply playing different roles in different settings, something that people experience when, for example, one wakes up as a lover, makes breakfast as a mother, and drives to work as a lawyer. The life practice of windows is of a distributed self that exists in many worlds and plays many roles at the same time. MUDs extend the metaphor. Now, in Doug's words, "RL" [real life] can be just "one more window."

On-line personae are objects-to-think-with for thinking about identity as multiple and decentered rather than unitary. With this comment I am of course not implying that MUDs or computer bulletin boards or chat rooms are causally implicated in the dramatic increase of people who exhibit symptoms of multiple personality disorder (MPD) (see Hacking 1995), or that people on MUDs have MPD, or that MUDding (or on-line chatting) is like having MPD. What I am saying is that the many manifestations of multiplicity in our culture, including the adoption of on-line personae, are contributing to a general reconsideration of traditional, unitary notions of identity. On-line experiences with "parallel lives" are part of the significant cultural context that supports new theorizations about multiple selves.

For example, in the psychoanalytic tradition, there are efforts to use a notion of flexibility and transparency as a way of introducing nonpathological multiplicity. Philip Bromberg's model of the healthy self is one whose resilience and capacity for joy comes from having access to its many aspects. Bromberg insists that our ways of describing "good parenting" should shift away from an emphasis on confirming a child in a "core self" and onto helping a child develop the capacity to negotiate fluid transitions between self states. The healthy individual knows how to be many but smoothes out the moments of transition between states of self. Bromberg (1994) says: "Health is when you are multiple but feel a unity. Health is when different aspects of self can get to know each other and reflect upon each other. Health is being one while being many." Here is a model of multiplicity as a conscious, highly-articulated "cycling through." Its contours are illuminated by a case study of on-line identity construction. I shall call him Case, a thirty-four-year-old industrial designer.

Case reports that he likes participating in on-line virtual communities as a female because (some would think paradoxically) it makes it easier for him to be assertive and confrontational. Case's several on-line female personae—strong, dynamic, "out there" women—remind him of his mother, whom he describes as a strong, "Katherine Hepburn type." His father was a mild-mannered man, a "Jimmy Stewart type." Case says that in "real life" he has always been more like his father, but he came to feel that he paid a price for his low-key ways. When he discovered MUDs, he recognized a chance to experiment:

For virtual reality to be interesting, it has to emulate the real. But you have to be able to do something in the virtual that you couldn't in the real. For me, my female characters are interesting because I can say and

do the sorts of things that I mentally want to do, but if I did them as a man, they would be obnoxious. I see a strong woman as admirable. I see a strong man as a problem. Potentially a bully.

For Case, if you are assertive as a man, it is coded as "being a bastard." If you are assertive as a woman, it is coded as "modern and together." Case's gender-swapping gives him permission to be more assertive within his virtual community and more assertive outside of it as well:

I've never been good at bureaucratic things, but I'm much better from practicing [in the on-line world] and playing a woman in charge. I am able to do things—in the real, that is—that I couldn't have before because I have played Katherine Hepburn characters.

Case says his Katherine Hepburn personae are "externalizations of a part of myself." In one interview with him, I use the expression "aspects of the self," and he picks it up eagerly, for his on-line life reminds him of how Hindu gods could have different aspects or subpersonalities, all the while being a whole self. In response to my question, "Do you feel that you call upon your personae in real life?" Case responds:

Yes, an aspect sort of clears its throat and says, "I can do this. You are being so amazingly conflicted over this and I know exactly what to do. Why don't you just let me do it?" MUDs give me balance. In real life, I tend to be extremely diplomatic, nonconfrontational. I don't like to ram my ideas down anyone's throat. On the MUD, I can be, "Take it or leave it." All of my Hepburn characters are that way. That's probably why I play them. Because they are smart-mouthed, they will not sugarcoat their words.

In some ways, Case's description of his inner world of actors who address him and are capable of taking over negotiations is reminiscent of the language of people with MPD. But the contrast is significant: Case's inner actors are not split off from each other or his sense of "himself." He experiences himself very much as a collective self, not feeling that he must goad or repress this or that aspect of himself into conformity. He is at ease, cycling through from Katherine Hepburn to Jimmy Stewart. To use Bromberg's language, on-line life has helped Case learn how to "stand in the spaces between selves and still feel one, to see the multiplicity and still feel a unity." To use the computer scientist Marvin Minsky's (1987) phrase, Case feels at ease cycling through his "society of mind," a notion of identity as distributed and heterogeneous that undermines traditional notions of identity. Identity, after all, from the Latin *idem*, has been habitually used to refer to the sameness between two qualities. On the Internet, however, one can be many and usually is.

It is often said that we are at the end of the Freudian century. Freud after all, was a child of the nineteenth century; of course, he was carrying the baggage of a very different scientific sensibility than our own. But those who make the most of their lives on the screen are those who can most deeply reflect on the aspects of self which are revealed there. Our need for a practical philosophy of self-knowledge, one that does not shy away from issues of multiplicity, complexity, and ambivalence has never been greater. It is time to rethink our relationship to computer culture and psychoanalytic culture as a proudly held joint citizenship.

3. THINKING ABOUT ALIVENESS BY PLAYING WITH COMPUTER TOYS

The genius of Jean Piaget (1960) showed us the degree to which it is the business of childhood to take the objects in our world and use how they "work" to construct theories—of space, time,

number, causality, life, and mind. In the mid-twentieth century, when Piaget was formulating his theories, a child's world was full of things that could be understood in simple, mechanical ways. A bicycle could be understood in terms of its pedals and gears, a windup car in terms of its clockwork springs. Children were able to take electronic devices such as basic radios and (with some difficulty) bring them into this "mechanical" system of understanding. Since the end of the 1970s, however, with the introduction of electronic toys and games, the nature of many objects and how children understand them has changed. When children today remove the back of their computer toys to "see" how they work, they find a chip, a battery, and some wires. Sensing that trying to understand these objects "physically" will lead to a dead end, children try to use a "psychological" kind of understanding (Turkle 1984, 29–63). Children ask themselves if the games are conscious, if the games know, if they have feelings, and even if they "cheat." Earlier objects encouraged children to think in terms of a distinction between the world of psychology and the world of machines, but the computer does not. Its "opacity" encourages children to see computational objects as psychological machines.

During the last twenty years I have observed and interviewed hundreds of children as they have interacted with a wide range of computational objects, from computer programs on the screen to robots off the screen (Turkle 1984; 1995). My methods are ethnographic and clinical. In the late 1970s and early 1980s I began by observing children playing with the first generation of electronic toys and games. In the 1990s I have worked with children using new generations of computer games and software, including virtual "pets," and with children experimenting with on-line life on the Internet.

Among the first generation of computational objects was Merlin, which challenged children to games of tic-tac-toe. For children who had only played games with human opponents, reaction to this object was intense. For example, while Merlin followed an optimal strategy for winning tic-tac-toe most of the time, it was programmed to make a slip every once in a while. So when children discovered strategies that allowed them to win, when they tried these strategies a second time, they usually would not work. The machine gave the impression of not being "dumb enough" to let down its defenses twice. Robert, seven, playing with his friends on the beach, watched his friend Craig perform the "winning trick," but when he tried it, Merlin did not make its slip and the game ended in a draw. Robert, confused and frustrated, accused Merlin of being a "cheating machine." Children were used to machines being predictable. But this machine held surprises.

Robert threw Merlin into the sand in anger and frustration. "Cheater. I hope your brains break." He was overheard by Craig and Greg, aged six and eight, who salvaged the by now very sandy toy and took it upon themselves to set Robert straight. Craig offered the opinion that, "Merlin doesn't know if it cheats. It won't know if it breaks. It doesn't know if you break it, Robert. It's not alive." Greg adds, "It's smart enough to make the right kinds of noises. But it doesn't really know if it loses. That's how you can cheat it. It doesn't know you are cheating. And when it cheats it don't even know it's cheating." Jenny, six, interrupted with disdain: "Greg, to cheat you have to know you are cheating. Knowing is part of cheating."

In the early 1980s such scenes were not unusual. Confronted with objects that spoke, strategized, and "won," children were led to argue the moral and metaphysical status of machines on the basis of their psychologies: Did the machines know what they were doing? Did they have intentions, consciousness, and feelings? These first computers that entered children's lives were evocative objects: they became the occasion for new formulations about the human and the

mechanical. For despite Jenny's objections that "knowing is part of cheating," children did come to see computational objects as exhibiting a kind of knowing. She was part of the first generation of children who were willing to invest machines with qualities of consciousness as they rethought the question of what is alive in the context of "machines that think."

During the past twenty years the objects of children's lives have come to include machines of even greater intelligence, toys and games and programs that make these first cyber-toys seem primitive in their ambitions. The answers to the classical Piagetian question of how children think about life are being renegotiated as they are posed in the context of computational objects (simulation games, robots, virtual pets) that explicitly present themselves as exemplars of "artificial life."

Although the presence of the first generation of computational objects (the games like *Merlin*, *Simon*, and *Speak and Spell*) disrupted the classical Piagetian story for talking about aliveness, the story children were telling about such objects in the early 1980s had its own coherency. Faced with intelligent toys, children took a new world of objects and imposed a new world order in which motion had given way to emotion and cognition as the discourse children used for talking about the aliveness of computers.

In the 1990s the computational objects that evoke evolution and "artificial life" (for example computer programs such as the games of the "Sim" series which stress decentralized and "emergent" processes) have strained that order to the breaking point. Children still try to impose strategies and categories, but they do so in the manner of theoretical *bricoleurs*, or tinkerers, making do with whatever materials are at hand, making do with whatever theory can fit a prevailing circumstance. When children confront these new objects and try to construct a theory about what is alive, we see them cycling through theories of "aliveness." Tim, thirteen, says of *SimLife*: "The animals that grow in the computer could be alive because anything that grows has a chance to be alive." Laurence, fifteen, agrees. "The whole point of this game," he tells me,

is to show that you could get things that are alive in the computer. We get energy from the sun. The organisms in a computer get energy from the plug in the wall. I know that more people will agree with me when they make a *SimLife* where the creatures are smart enough to communicate. You are not going to feel comfortable if a creature that can talk to you goes extinct.

An eleven-year-old named Holly watches a group of robots with "onboard" computational intelligence navigate a maze. The robots use different strategies to reach their goal, and Holly is moved to comment on their "personalities" and their "cuteness." She finally comes to speculate on the robots' "aliveness" and blurts out an unexpected formulation: "It's like *Pinocchio*."

First *Pinocchio* was just a puppet. He was not alive at all. Then he was an alive puppet. Then he was an alive boy. A real boy. But he was alive even before he was a real boy. So I think the robots are like that. They are alive like *Pinocchio* [the puppet], but not "real boys."

She clears her throat and sums up her thought: "They [the robots] are sort of alive."

Robbie, a ten-year-old who has been given a modem for her birthday, puts the emphasis on mobility when she considers whether the creatures she has evolved on *SimLife* are alive.

I think they are a little alive in the game, but you can turn it off and you cannot "save" your game, so that all the creatures you have evolved go away. But if they could figure out how to get rid of that part of the program so that you would have to save the game and if your modem were on, then they could get out of your computer and go to America Online.

Sean, thirteen, who has never used a modem, comes up with a variant on Robbie's ideas about SimLife creatures and their Internet travel: "The [Sim] creatures could be more alive if they could get into DOS." Thus, children cycle through evolution and psychology and resurface ideas about motion in terms of the communication of bits on the Internet. In children's talk about digital "travel" via circulating disks or over modems, in their talk of viruses and networks, biology and motion are resurfacing in a new guise, now bound up in the ideas of communication and evolution. Significantly, the resurfacing of motion (Piaget's classical criterion for how a child decides whether a "traditional" object is alive) is now bound up with notions of a presumed psychology: children were most likely to assume that the creatures in Sim games have a desire to "get out" of the system and evolve in a wider computational world.

My current collection of comments about life by children who have played with the artifacts of artificial life that are available in the popular culture (small mobile robots, the games of the "Sim" series, and Tierra, a program which simulates evolutionary selection through survival of the fittest) includes the following notions: the robots are in control but not alive, would be alive if they had bodies, are alive because they have bodies, would be alive if they had feelings, are alive the way insects are alive but not the way people are alive; the Tierrans are not alive because they are just in the computer, could be alive if they got out of the computer and got onto America Online, are alive until you turn off the computer and then they're dead, are not alive because nothing in the computer is real; the Sim creatures are not alive but almost-alive, they would be alive if they spoke, they would be alive if they traveled, they're alive but not "real," they're not alive because they don't have bodies, they are alive because they can have babies, and finally, for an eleven-year-old who is relatively new to SimLife, they're not alive because these babies don't have parents. She says: "They show the creatures and the game tells you that they have mothers and fathers, but I don't believe it. It's just numbers, it's not really a mother and a father." There is a striking heterogeneity of theory here. Different children hold different theories and individual children are able to hold different theories at the same time.

In his history of artificial life, Steven Levy (1992, 6–7) suggested that one way to look at where artificial life can "fit in" to our way of thinking about life is to envisage a continuum in which Tierra, for example, would be more alive than a car but less alive than a bacterium. My observations suggest that children are not constructing hierarchies but are heading toward parallel definitions of life, which they "alternate" through rapid cycling. Multiple and alternating definitions, like thinking comfortably about one's identity in terms of multiple and alternating aspects of self, become a habit of mind.

Children speak easily about factors which encourage them to see the "stuff" of computers as the same "stuff" of which life is made. For example, the seemingly ubiquitous "transformer toys" shift from being machines to being robots to being animals (and sometimes people). Children playing with these objects are learning about the potentially fluid boundaries between mechanism and flesh.

I observe a group of seven year olds playing with a set of plastic transformer toys that can take the shape of armored tanks, robots, or people. The transformers can also be put into intermediate states so that a "robot" arm can protrude from a human form or a human leg from a mechanical tank. Two of the children are playing with the toys in intermediate states (that is, in states somewhere between being people, machines, and robots). A third child insists that this is not right. The toys, he says, should not be placed in hybrid states. "You should play them as all tank

or all people." He is getting upset because the other two children are making a point of ignoring him. An eight-year-old girl comforts the upset child. "It's okay to play them when they are in-between. It's all the same stuff," she said, "just yucky computer 'cy-dough-plasm.'" This comment is the expression of a cyborg consciousness as it expresses itself among today's children: a tendency to see computer systems as "sort of" alive, to fluidly cycle through various explanatory concepts, and to willingly transgress boundaries. Most recently, the transgressions have involved relationships with "virtual pets" (the first and most popular of these were Tamagotchi) who demand of their owners to feed them, play games with them, inquire about their health and mood, and, when they are still babies, clean up their virtual "poop." Good parenting of a Tamagotchi will produce a healthy offspring; bad parenting will lead to illness, deformity, and finally, to the pet's virtual death. The Tamagotchi are only the first in a projected series of computational objects that seem destined to teach children a new lesson about the machine world: that computational objects need to be related to as another life form.

Today's adults grew up in a psychological culture that equated the idea of a unitary self with psychological health, and in a scientific culture that taught that when a discipline achieves maturity, it has a unifying theory. When they find themselves cycling through varying perspectives on themselves (as when they cycle through a sequence such as "I am my chemicals" to "I am my history" to "I am my genes") they usually become uncomfortable (Kramer 1993). People who grew up in the world of the mechanical are more comfortable with a definition of what is alive that excludes all but the biological and resist shifting definitions of aliveness. So, when they meet ideas of artificial life which put the processes of replication and evolution rather than biology at the center of what is alive (Langton 1989) they tend to be resistant, even if intrigued. They feel as though they are being asked to make a theoretical choice against biology and for computational process. Children who have grown up with computational objects don't experience that dichotomy. They turn the dichotomy into a menu and cycle through its choices. Today's children have learned a lesson from their cyborg objects. They cycle through the cy-dough-plasm into fluid and emergent conceptions of self and life.

NOTES

This essay is drawn from Turkle (1995).

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